Hillside Issues, Goals, Choices DRAFT

DRAINAGE

“A whiskey is for drinking, water is for fighting over.”

Mark Twain

A. Introduction & Summary

The Hillside has a unique combination of characteristics that affect drainage. It receives a greater amount of rainfall and snow than the Anchorage Bowl and has some of the steepest slopes. It contains a complex arrangement of landforms and soils resulting in some areas that drain quickly and some that have high ground water.

Development began on the Hillside at the lower elevations and in areas containing gentler land slopes. Homes were typically constructed on large lots with limited clearing of native vegetation. Gravel roads and driveways provided vehicular access to these large-lot rural style homes. No drainage plan was developed for the Hillside and as a result, some homes were constructed in low areas, some wetlands were filled, and some natural drainageways were diverted. Even so, drainage-related problems were minimal because of the relatively low-impact development style typical of this initial development.

Development is changing on the Hillside and has moved up the hillsides into higher elevations and steeper slopes. New subdivisions are being constructed at higher densities with greater land clearing. Driveways and streets are wider, paved, and have sidewalks. Runoff on the Hillside is increasing as a result. This increase has been dramatic with areas downstream of some new subdivisions receiving increased flows many times greater than undeveloped conditions.

Even though development is changing and storm water runoff is increasing, the traditional Hillside approach to managing drainage remains the same. Drainage is currently dealt with in a piece-meal fashion with subdivisions, homeowners, and service areas each attempting to convey runoff through or around properties. This informal approach results in numerous drainage-related problems. Problems will worsen and new troubles will surface unless a new management and maintenance approach to Hillside drainage is adopted.

- What is drainage and what affects it?
- Is drainage causing problems on the Hillside now and will it get worse?
- How is drainage regulated now and should this be changed?
- How is drainage maintained now and is this the best way?
- How can we manage drainage to avoid future problems?
**B. Existing Drainage Conditions**

Ground slope and cover affect the amount of runoff resulting from a rainstorm or melting snow. Steeper slopes cause surface water to move quickly and with more energy than gentle slopes. Land surfaces such as forests and wetlands help absorb and slow surface water runoff. Impervious surfaces such as roofs and pavement have little ability to slow or absorb runoff. Subsurface materials also affect the runoff rate. Features such as clay soils, bedrock, and areas of high groundwater have little impact on decreasing the volume or speed of surface runoff. Areas that drain well such as ground with gravels and cobbles can infiltrate large amounts of runoff.

The Hillside has a unique combination of these characteristics. Elevations range from just above sea level to over 2000 feet. This dramatic elevation difference results in a meteorological condition called the orographic effect. Rainfall amounts increase with elevation along the Hillside. A rainstorm will produce more than half again as much rain along Hillside Drive than it does along the New Seward Highway. The areas receiving the most rainfall typically also have the steepest slopes. These steeper slopes result in runoff that has greater velocity. Higher velocities reduce infiltration and increase erosion and flood damage. Another condition unique to the Hillside is the occurrence of warm winter winds called Chinooks. These winds blow stronger and more frequently on the Hillside than in the Anchorage Bowl, and result in more dramatic snow melt. Subsequent cold temperatures result in the thaw-freeze cycle conducive to the development of roadway icing and glaciation.

Subsurface conditions vary greatly within the Hillside. Ancient geologic features such as glaciers, oceans, lakes and streams created a complex arrangement of landforms and soils located on the Hillside. Some areas drain quickly while some drain more slowly as a result. Some areas have high groundwater levels while in others the groundwater depths are deep. Each characteristic affects the way snowmelt, groundwater, and rainfall runoff drain within the hillside.

Runoff increases when native vegetation is removed and replaced with landscaping and impervious surfaces such as homes, driveways, and roads. Older more established areas of the Hillside typically contain more native vegetation, lower density developments, and gravel driveways and roads. The current method of development results in greater areas of impervious surfaces and larger areas cleared for landscaping (See Figure 6.1). This new development approach can result in peak runoff many times that of undeveloped conditions (A White Paper Titled Development and Runoff evaluates runoff impacts from development scenarios). In addition, road ditches have become the primary...
mechanism for conveying runoff through the Hillside. Undersized roadside ditches are resulting in increased roadway glaciation and erosion.

No single entity is currently responsible for managing drainage from the very top of each watershed to the bottom. Instead, drainage is currently dealt with on a piece-meal fashion with subdivisions, homeowners and service area managers each attempting to convey runoff through or around their properties. This informal approach has resulted in numerous problems including:

- Roadway icings and areas of glaciation
- Flooding and high ground water
- Increased erosion and subsequent sedimentation
- Increased maintenance costs
- Decreased water quality and degradation of downstream waterways

Figure 6.2 shows an example of this unplanned approach to managing drainage. As can be seen in the example, this informal approach creates significant drainage-related problems.

Figure 6.3 presents a summary of known major problems on the Hillside caused by this lack of planning. As shown in this figure, the majority of drainage-related problems are located south and east of Rabbit Creek Road. This southern portion of the Hillside is experiencing rapid development, has steeper land slopes, and is higher in elevation than the northern and western areas.

Without a drainage plan, development will increase runoff to systems that already have problems and are not designed to convey increased flow. Existing drainage-related problems will worsen and new problems will be created, particularly in the steeper, higher elevation areas of the Hillside.
C. Opportunities and Constraints

The Hillside contains wetlands, streams, areas of high ground water, low-lying areas, and slopes of varying steepness. Some of the characteristics can be used to provide important water quality or storm water management functions while other characteristics have the potential to increase the problems caused by drainage if not carefully managed. Identifying these characteristics and their associated relationship to drainage is an important step in developing an effective drainage plan for the Hillside.

Several Hillside features are vital to reduce flooding or improve water quality and should be protected. The features include all streams, natural drainageways, wetlands, and existing drainage ditches. It is recommended that all of the Hillside wetlands be protected from development and that easements be secured for all of the streams, natural drainageways, and drainage ditches. The easements would allow only limited land cover conversions such as construction of trails and to provide access for maintenance. The rewrite of Title 21 (currently under review) proposes stream setbacks based on zoning not on stream function. When the Title 21 proposed approach is mapped it shows that streams within the Hillside would have easement widths that would vary from narrow to large to narrow along stream segments in a discontinuous fashion. A better approach would be to set easement widths (Figure 6.4) based on drainageway function as follows:

- Anadromous fish streams\(^1\): 100 feet both sides of each edge of stream bank.
- Major streams\(^1\): 50 feet both sides of each edge of stream bank.
- Perennial streams\(^2\): 50 feet total width centered on the stream.
- Drainageways and ditches\(^3\): 20 feet total width centered on the drainageway.

Characteristics of certain Hillside features have the potential to increase drainage-related problems. These features include closed-cell drainages (naturally occurring low areas where runoff flows into the area but cannot exit), areas of high icing potential, and steep land slopes. These features were used to create a drainage-related limitation ranking of all areas within the Hillside (Figure 6.5). The ranking includes areas having few, some, moderate, and numerous limitations. The ranking does not imply that development cannot occur. The ranking provides insight into the amount of drainage controls or design effort that would be required for a development to avoid increased flooding, icing and glaciation, or erosion. The ranking can be used to develop new zoning, onsite controls, and development criteria for the Hillside District Plan.

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\(^1\) Based on DNR Division of Forestry Alaska Forest Resources and Practices Act; Article 2, Section 41.17.116.(b)(4); Effective July 1, 2006

\(^2\) Based on current MOA Title 21 stream setback ordinance

\(^3\) Based on industry standard maintenance easement width
Some Hillside features such as wetlands can provide opportunities for drainage management. If set aside, these features could be used to store drainage to reduce peak flows and/or provide water quality functions. In addition, restoring original channel alignments and drainage paths would mitigate many existing drainage problems. Figure 6.6 presents the Hillside features identified as providing potential drainage opportunities.

D. Drainage Regulations

Numerous federal, state, and local regulations address drainage on the Hillside. The following provides a brief overview of these regulations. Figure 6.7 presents this summary graphically. A White Paper Titled Drainage Regulations provides a more extensive summary of drainage-related regulations.

Local Regulations

- Anchorage Comprehensive 2020 Plan – sets drainage-related goals along with design, policies, and strategies for implementation.
- Anchorage Municipal Code – includes 31 titles, the two of greatest importance to drainage are Titles 21 and 27:
  - Title 21 Land Use Regulations – The MOA has recently adopted four revised chapters and is in the process of rewriting the remaining chapters within Title 21. The new chapters now require subdivision layout to be consistent with natural drainage features and historic drainage patterns and to avoid causing damage to these water features. They further require the developer to ensure that the new development will not adversely impact existing drainage facilities, water bodies, wetlands, or neighboring parcels.
  - Title 27 Service Areas - establishes authority and procedures for service areas to provide limited road maintenance services including drainage ditch clearing and ice control on rural roads located within the Hillside.
- Anchorage Design Criteria Manual (DCM) – provides specifics for how to design and construct drainage-related facilities on the Hillside. A rewrite of the DCM is currently under review.

State & Federal Regulations

- State 401 water certification – reviews construction plans for storm water systems.
- Section 404 wetlands permitting – regulates fill placed in wetlands with the higher quality wetlands, as ranked in the Anchorage Wetlands Management Plan, requiring more stringent fill requirements.
- National Flood Insurance Program (NFIP) – this program, managed by the Federal Emergency Management Agency (FEMA), protects people and property from
flooding by restricting development within mapped flood zones. Rabbit Creek & Potter Marsh are Hillside water features that are currently flood hazard mapped.

- Clean Water Act National Pollutant Discharge Elimination System (NPDES) – this program, administered by the US EPA and the US Army Corps of Engineers, controls water pollution by regulating point sources that discharge pollutants into waters of the United States. The NPDES program helps protect Hillside water quality by requiring developers to prepare storm water pollution protection plans.

### E. Existing Drainage Maintenance

There are approximately 230 miles of roads located within the Hillside. Runoff from much of the Hillside is currently conveyed to ditches located along these roads. These roads, ditches, and culverts are maintained by Service Areas, the Alaska Department of Transportation and Public Facilities (DOT&PF), the Municipality of Anchorage (ARDSA), and home owners associations (HOAs) and Ad hoc maintenance groups. The following table presents the total miles of roads maintained by each of these entities within the HDP study area. Figure 6.8 graphically presents the current boundaries of these maintenance groups.

<table>
<thead>
<tr>
<th>Maintenance Entity</th>
<th>Roads Maintained</th>
<th>(% of Total Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchorage Roads and Drainage Service Area</td>
<td>45</td>
<td>19%</td>
</tr>
<tr>
<td>Alaska Department of Transportation</td>
<td>30</td>
<td>13%</td>
</tr>
<tr>
<td>Service Areas</td>
<td>94</td>
<td>41%</td>
</tr>
<tr>
<td>Home Owners Associations / Ad Hoc</td>
<td>61</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Total Study Area:</strong></td>
<td><strong>231</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Service areas maintain the largest percentage of roads (41%) within the Hillside. The Hillside includes three types of service areas - Limited Road Service Areas (LRSA), Rural Road Service Areas, and Service Areas. Each of the 20 separate service areas has a locally elected Board of Supervisors that determines the scope of work and oversees completion of the work by private contractors. Funding is provided by a uniform tax levy on the residents of the service area that is collected by the Municipality of Anchorage. Rural Road Service Areas (South Goldenview) and Service Areas (Glen Alps) have the ability to collect fees to construct capital improvement projects, LRSAs cannot.

As seen on Figure 6.8, the service boundaries do not coincide with watershed or drainage boundaries.

The DOT&PF and ARDSA together maintain approximately 32 percent of Hillside roads. These agencies have annual budgets to maintain existing roads and drainage systems. The agencies have the ability to fund the design and construction of capital
improvement projects. In addition, the DOT&PF and the ARDSA construct drainage systems based on drainage plans. The planning and design process helps reduce maintenance needs by properly sizing and locating drainage facilities.

The remaining roads within the Hillside, nearly 30 percent, are either un-maintained or are maintained by ad hoc groups and homeowners associations. These entities conduct maintenance by collecting fees from homeowners, operate under informal agreements, and perform varying levels of service. These entities do not have the planning, design, or funding capabilities or mechanisms required to identify and construct major drainage system upgrades. A White Paper Titled *Drainage Maintenance* provides a more extensive summary of how drainage is currently maintained on the Hillside along with a summary of reported problems.

**F. Drainage Management Issues & Options**

A summary of the drainage-related issues facing the Hillside include:

- Runoff is currently causing problems including icing, flooding, erosion, and water quality and aquatic habitat degradation.

- Development is increasing runoff and has caused an associated increase in drainage-related problems.

- Drainage conveyance systems are currently planned in a piece-meal fashion. This approach has resulted in undersized conveyances that lack connectivity. This has lead to erosion, sedimentation, flooding, and icing and glaciation problems.

- Natural drainageways and wetlands have been developed and diversions have occurred. Remaining wetlands, streams, and natural drainageways provide vital storm water management functions and should be protected.

- Certain Hillside features require careful planning and consideration to avoid increased drainage problems.

- The Hillside contains natural features that can provide opportunities for managing drainage.

- Existing regulations and drainage design criteria do not adequately address the unique conditions of the Hillside and are not adequately enforced.

- Roadside drainage is currently maintained by numerous entities with most of these lacking the ability to plan, design, fund, and construct major system upgrades. This has resulted in inefficient use of funds being spent on repeat maintenance efforts.
Based on the unique issues facing the Hillside, the following four-pronged approach to manage drainage is recommended and described below. These recommendations are preliminary and are meant for discussion purposes only.

1) Require and enforce onsite controls for new development including development of Hillside specific design criteria.

2) Implement watershed management plans.

3) Create institutional structures for the management, maintenance, and funding of a Hillside drainage management plan.

4) Extend wetlands, natural drainageways, and flood hazard mapping.

1. Onsite Controls & Hillside Design Criteria

Current development practices result in peak storm water flows many times greater than undeveloped conditions. Simple onsite controls will help reduce runoff and should be required for all new development. The onsite controls must be easy to implement, sustainable with little to no maintenance, and difficult for homeowners to modify or eliminate. Onsite controls should include design of drainage conveyance systems that safely collect and convey runoff from within the development to carefully planned discharge points. Preferably, these improvements are not co-located with roads to avoid icing potential. Incentives for provision of greater runoff reductions than required should be considered. Title 21 and the MOA drainage chapter of the Design Criteria Manual (DCM) should be modified to require specific onsite controls for all new Hillside development and provide Hillside-specific design guidance including icing controls.

2. Watershed Plans

While onsite controls will help reduce impacts of runoff from new development, they will not completely reduce peak flows to predevelopment conditions. Nor will they solve existing drainage problems. It is recommended that watershed plans be developed that would identify and design (to a concept level) water quantity and quality controls required to fix existing problems and provide adequate conveyance for future flows. The plans would include mapping of stream easements and wetlands. Title 21 and the drainage chapter of the MOA DCM should be modified to require all new developments adhere to the Hillside watershed plans.

3. Institutional Structures

Capital improvement projects identified in the watershed plans will require funds to construct. Administration of the program would also require staff and funds to enforce adherence to new development and drainage criteria including onsite controls. Staff and equipment will also be required to maintain new drainage facilities. Implementing the recommended management approach will require development of funding, management, and maintenance mechanisms. Upcoming work for the Hillside District Plan will evaluate options and present recommendations for these institutional structures. Options considered will include use of the existing road maintenance groups or creation of one or
more new institutions for the funding and management of a watershed-based drainage approach.

4. Mapping
The National Flood Insurance Program (NFIP) protects people and property from flooding by restricting development within a mapped flood zone. Only the lower reaches of Rabbit Creek and Potter Marsh currently have flood hazards mapped and are included in the FEMA program. Extension of flood hazard mapping along additional Hillside streams would help reduce flood risk to properties within the Hillside. Many wetlands are located on the Hillside. The wetlands attenuate peak runoff flows and provide valuable biological and water quality functions. Many of the wetlands are unmapped. Improving Hillside wetlands mapping would help protect these resources from development as well as avoid potential development-related problems caused by constructing homes in the areas prone to high ground water levels.